

Civil Service Workforce Market Supply and the Effect on Cost Estimating Relationship (CERS) that may effect the Productivity Factors for Future NASA Missions

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Abstract

With the upcoming retirement of the Baby Boomers on the horizon will leave a workforce age gap between younger generation (the future NASA decision makers) and the gray beards. This paper will reflect on the average age of workforce across NASA Centers, the Aerospace Industry and other Government Agencies, like DoD. This papers will dig into Productivity and Realization Factors and how they get applied to bi-monthly (payroll data) for true FTE calculations ~ that could be used at each of the NASA Centers and other business systems that are on the forefront in being implemented. This paper offers some comparative costs analysis / solutions, from simple - full time equivalent (FTE) cost estimating relationships CERs versus CERs for monthly time-phasing activities for small research projects that start and get completed within a government fiscal year. This paper will present the results of a parametric study investigating the cost-effectiveness of different alternatives performance based cost estimating relationships (CERs) and how they get applied into the Center's forward pricing rate proposals (FPRP). True CERs based on the relationship of a younger aged workforce will have some effects on labor rates used in both commercial cost models and other internal home-grown cost models which may impact the productivity factors for future NASA missions.

Introduction

The Health of the Agency as a Whole: The Vision for Space Exploration proclaimed by President George W. Bush in 2004 sets NASA and the nation on a bold path to return to the moon and beyond. One day NASA will put a humans on the red planet Mars. This is a long term endeavor, not a race ~ is subject to constraints imposed by annual funding/budgets as approved by Congress. It may take years to implement.

The most significant issue raised annually is whether NASA and the United States will have the workforce "Supply" to achieve the vision. The issues ranges from short-term and long-term concerns or the health of the agency as a whole. There are several published committee reports have concluded that in the short term, NASA does not posses the requisite in-house personnel with the experience in human space flight systems development needed to implement the vision space exploration. NASA Administrator, Mike Griffin has set center ceiling for civil service full time equivalents (FTE) at the ten NASA Centers and there are on-going studies implemented in the spring of fiscal year 2008 to study on-site and near site contractors levels. The thinking is: if center ceilings are capped then workforce demand must match workforce supply ~ thus the gap must be filled with on-site contractors. It is believed that one or two NASA Centers has an increased amount of on-site contractors meet their workforce requirements. Long term; NASA has to ask if it attracting and developing the talent it will need to execute a mission return to the Moon. The agency must identify what it needs to attract and develop a world-

class workforce to explore other worlds. One would have to address the current workforce skills for overseeing the development of new spacecraft systems and platforms, launch vehicles, a vast variety of science endeavors, and retiring the existing space shuttle fleet no later than FY10. Most of the engineers who work on NASA projects are in industry, and most of the scientist are at universities. Retaining the proper number of each component of the broader aerospace poses fundamentally different challenges.

If NASA does not nurture and train its own potential workforce there is no guarantee that any other government agency or private entity will do so, nor that the agency will receive the high-quality personnel that it requires to achieve the ambitious goals of returning humans to the Moon and eventually send them to Mars.

Like the Goldilocks Syndrome NASA Centers continue to state “we need more people”, Congress, special committees, and others have stated “You need less people, you need to outsource more work”. NASA Administrator, Dr. Michael Griffith says, “the Agency is about the “right size”, we need to recapture in-house intellectual capability”. It is the authors opinion there is some controversy as to the size of NASA workforce and more the specially the statements above are too general. To achieve good workforce planning techniques; 1.) work needs to be planned at the task level. 2.) Work is not going to where the workers are (skill mix) issues at some centers. 3.) NASA workforce is ageing, it needs to more hire fresh-outs and implement a long term strategy to fill the gap (in the 30 to 49 age range) and other measures to ensure an effective aerospace workforce as an ecosystem. See Figure 1-1

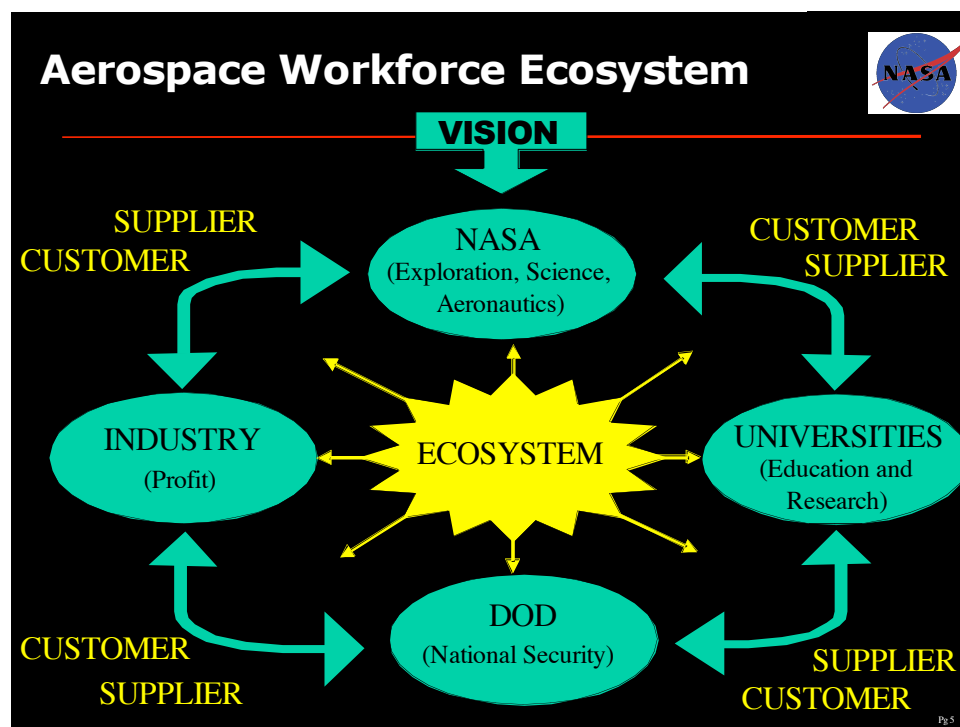


Figure 1-1 Aerospace Workforce Ecosystem

NASA’s workforce requirements and challenges cannot be considered in isolation from those of other government and industry organizations. NASA is part of an aerospace ecosystem in which the health of one organization or sector can effect another.

The Health of the Agency as of Today

The current NASA workforce is about 18,000 government civil service employees, down 9% from 1998. The average age starting October 1st 2007 is 46.4, up two point from the prior year. The average age for federal service is 17.9 years. The average civil service grade is around a GS 13. See the following figure 1-3 for a ten year comparison. Note that every year has increased in every column.

Average Age at NASA

The average age of NASA’s workers has marched steadily upward, and the agency now has a relatively low number of younger workers to assume future leadership roles in NASA ~ as older workers retire. If it does

nothing to achieve a better age distribution across its overall internal workforce, NASA will suffer a gap not only in technical leadership, but also in overall technical experience.

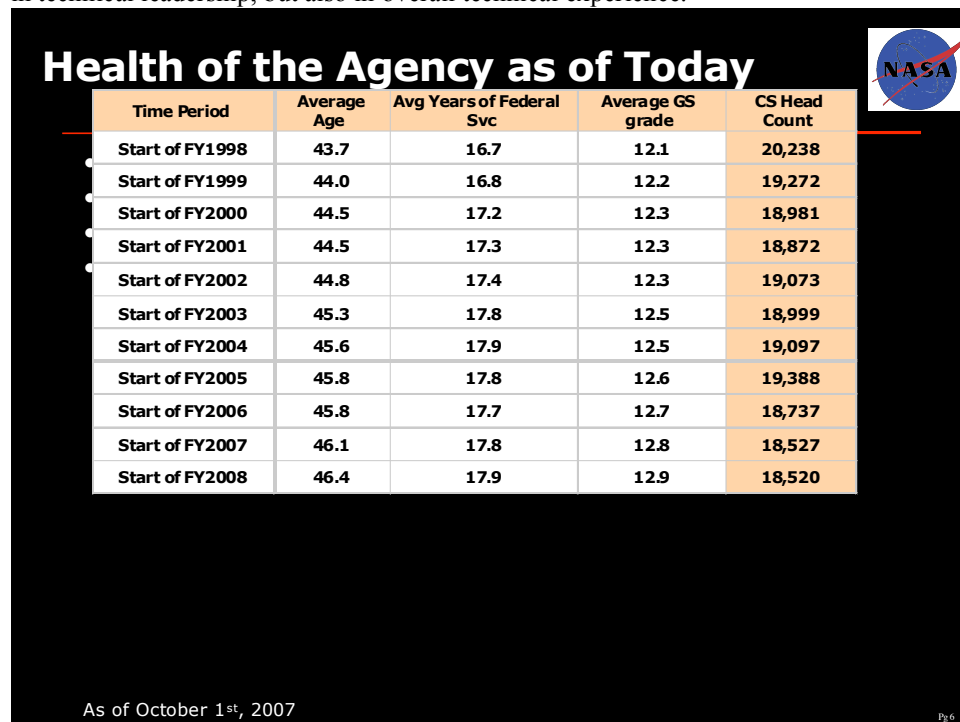


Figure 1-2 Health of the Agency as of Today

When we dissect the number of civil service workforce into five major categories, we start to unravel the true health of the Agency. With a new NASA Administrator in 2004, a new strategy was made to curtail full time permanents and foster a “term appointment” idea. The over-arching strategy is to hire-in new workforce with options. There are two term appointment options; one tailored for the engineering staff and the other for project management and other administrative type functions. Term appointments combined have seen a 300% percent increase as of October 1st 2007, with a 15% quota or more set at each NASA Center. (See Figure 1-3)

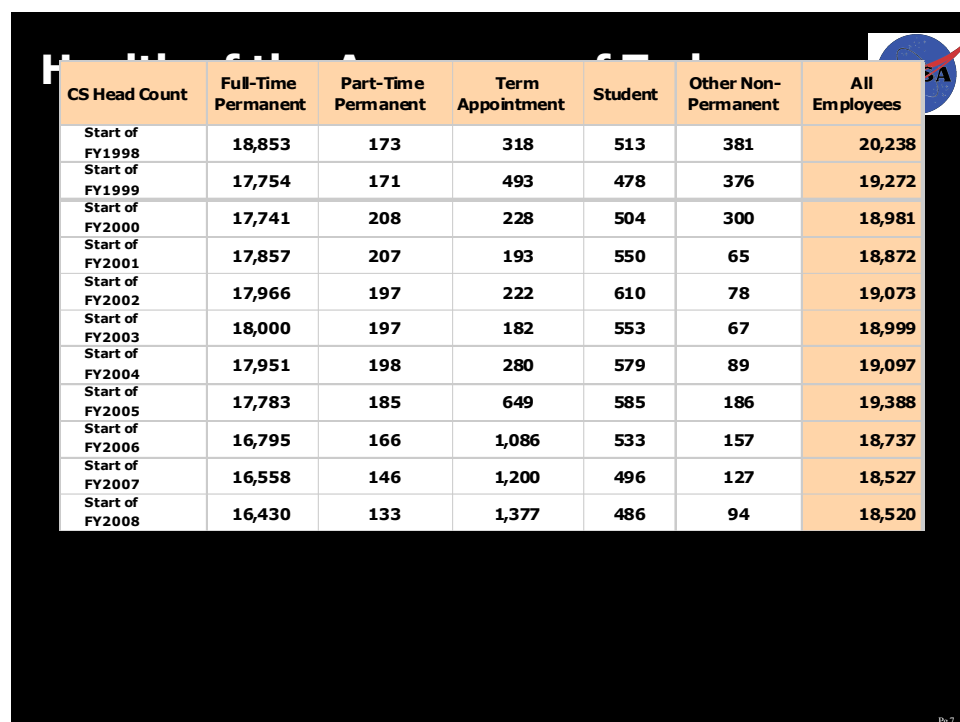


Figure 1-3 Health of the Agency as of Today

NASA civil workforce is better educated than ten years ago. There has been a steady increase in degreed professionals every year for the last ten years. Over 80% percent of NASA workforce has a Associate Degree or higher with 11% having a Doctorate. (See Figure 1-4)

CS Head Count as % of row total	Doctorate Degree	Master's Degree	Master's Equivalent	Bachelor's Degree	Associate Degree	No Degree	Unspecified	All Degrees
Start of FY1998	9.31%	20.94%	1.14%	40.14%	5.92%	22.55%	0.00%	100.00%
Start of FY1999	9.81%	21.14%	1.17%	39.92%	5.97%	22.00%	0.00%	100.00%
Start of FY2000	10.17%	21.88%	1.24%	38.91%	5.96%	21.84%	0.00%	100.00%
Start of FY2001	9.93%	22.21%	1.07%	39.27%	5.98%	21.55%	0.00%	100.00%
Start of FY2002	10.30%	22.66%	1.02%	39.29%	5.86%	20.88%	0.00%	100.00%
Start of FY2003	10.48%	22.94%	1.05%	39.57%	5.78%	20.19%	0.00%	100.00%
Start of FY2004	10.60%	23.17%	1.02%	39.78%	5.65%	19.78%	0.00%	100.00%
Start of FY2005	10.60%	23.52%	0.96%	40.47%	5.76%	17.84%	0.85%	100.00%
Start of FY2006	10.83%	24.52%	1.01%	41.02%	5.31%	17.00%	0.30%	100.00%
Start of FY2007	10.83%	25.83%	1.01%	40.92%	5.08%	16.21%	0.12%	100.00%
Start of FY2008	10.87%	26.56%	1.01%	40.86%	5.00%	15.51%	0.18%	100.00%

Figure 1-4 Health of the Agency as of Today

It is known that people are living longer, coupled with current economic factors, people do not want to retire, leads to a prolong baby boomer syndrome. The chart below (See Figure 1-5) starts to address this phenomenon.

CS Head Count as % of row total	Under 20	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69
Start of FY1998	0.34%	2.34%	5.44%	13.55%	17.32%	15.00%	13.90%	14.02%	10.96%	5.01%	1.47%
Start of FY1999	0.31%	2.23%	4.31%	12.45%	18.14%	15.88%	14.62%	13.85%	10.94%	5.20%	1.44%
Start of FY2000	0.36%	2.37%	3.30%	11.04%	18.25%	16.75%	14.96%	14.12%	11.00%	5.54%	1.63%
Start of FY2001	0.47%	2.85%	3.21%	9.44%	17.90%	17.87%	15.76%	14.17%	10.46%	5.58%	1.65%
Start of FY2002	0.37%	3.47%	3.05%	8.03%	16.81%	19.03%	15.84%	14.69%	10.58%	5.65%	1.74%
Start of FY2003	0.24%	3.41%	3.02%	6.93%	15.46%	19.62%	16.70%	14.46%	11.26%	6.09%	2.01%
Start of FY2004	0.36%	3.45%	3.41%	5.68%	13.97%	20.14%	17.22%	14.82%	11.37%	6.45%	2.29%
Start of FY2005	0.26%	3.65%	4.01%	5.05%	12.80%	20.16%	17.99%	15.02%	11.39%	6.32%	2.41%
Start of FY2006	0.19%	3.62%	4.35%	4.92%	11.27%	20.02%	19.54%	15.84%	11.33%	5.94%	2.11%
Start of FY2007	0.16%	3.05%	4.92%	4.65%	9.87%	19.12%	21.14%	16.26%	11.71%	6.10%	2.17%
Start of FY2008	0.16%	2.92%	5.03%	4.90%	8.63%	17.77%	21.91%	17.49%	11.52%	6.48%	2.33%

Figure 1-5 Health of the Agency as of Today

Baby Boomers on the Horizon:

There is no evidence of a downturn in the national supply of new talent for aerospace engineering and space sciences. The supply of and the demand for new aerospace workers appear to be relatively well matched at present, as evidenced in part by the fact that salaries in aerospace engineering are not increasing sharply relative to those in other fields. The one exception is engineering salaries in the petrochemical industry. Due to several factors there are categories some relative (See Figure 2-1)

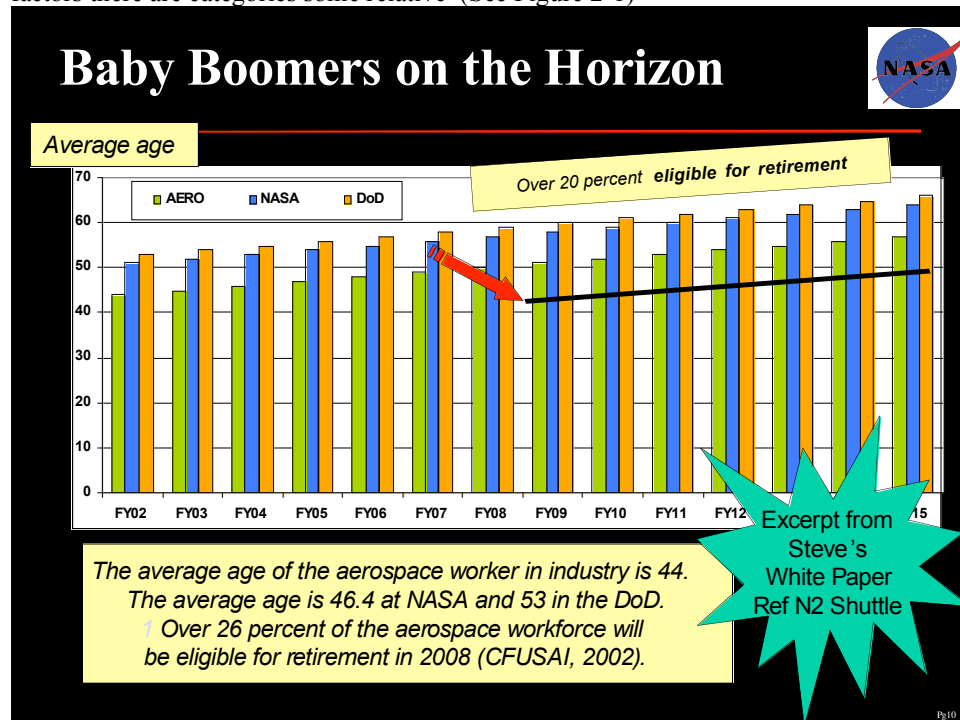


Figure 2-1 Baby Boomers on the Horizon

When you take the data from chart Figure 1-6 (see prior) and simply perform a line graph, one can conclude that workforce band-width is getting narrower and taller over time. (See Figure 2-2)

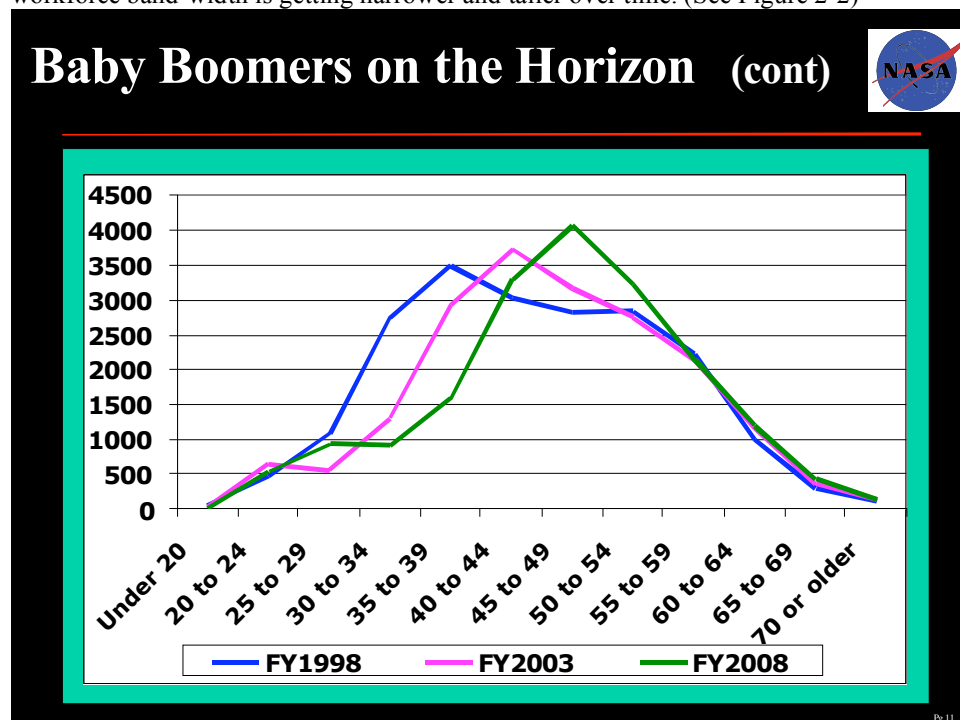


Figure 2-2 Baby Boomers on the Horizon

Here is one the meat balls to take away from this paper. If one were to draw a trend line from the peaks of 1998, 2003, 2008 and forecast out to 2013. The top of the bell shape curve projected out to GFY 2013 would be pretty close to age 59. The assumption is ~ if you took the freeze (of hiring young people) a decision that was made in the prior Administration call it the “Workforce 39 to 49 Age Gap” as seen in figure 2-3 using advance modeling techniques. Could be portrayed as the “peak to the baby boomer syndrome” and also seen as a near-term risk for the Agency.

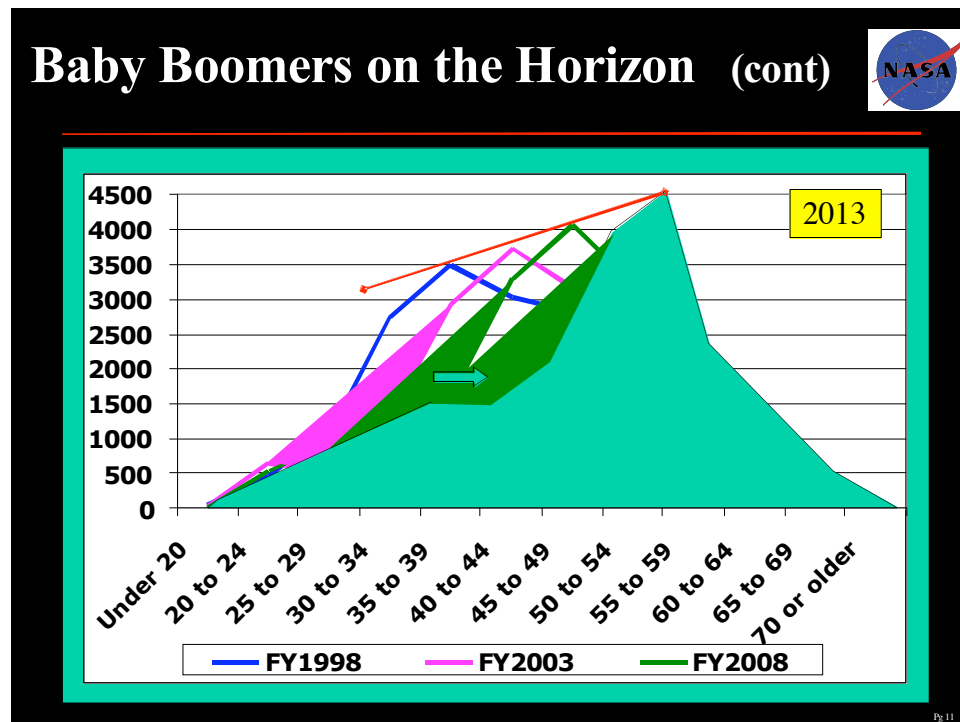


Figure 2-3 Baby Boomers on the Horizon

How do we validate the data from the above chart or achieve a different perspective?

Good question, The obvious answer is everyone turns in a time card every two weeks. One could make the analogy that if there is a higher concentration of older workforce then the same workforce has a higher amount of annual leave. One approach is to query the time card system. Perform a simple analysis for the same period of time and compare the productivity and realization factors. The sensitivity levels between each year may be an indication as where the baby boomer syndrome may level off. This is extremely difficult to do because of the versatile in the workforce. However, as cost estimators we now that labor rates come from cost estimating relationships of (CERs). As far as I can tell the only guidance given from NASA headquarters is to use the Cost Estimators Handbook (CEH). The hand book gets released every two years. Inside the handbook are links to the NASA New Start Indices' and Inflation Calculators. The problem here is it is not tied to the same rates being used for the earned value management system (EVMS). Again this item (EVM) is being scrutinized at the time this paper is being written.

Another option is to cross-check the civil service labor rates and other cost estimating relationship (CERs) coming from the Office of the Chief Financial Officer (OCFO). Each NASA Center has a CFO that governs the annual budget, the rates and factors per guidance from the Financial Management Requirement (FMR) handbook.

How does a Cost Estimator determine good CERs for Workforce Planning?

The standard method in generating a good CER is to pull actuals, add inflation and escalate the rate for subsequent years. However, upon a deeper analysis, one may want to consider adding a “productivity factor” to the standard labor CERs already generated for each of the NASA Centers.

Productivity and Realization Factors Examined:

What is a Productivity Factor and why do we care to study the effect? The Productivity Labor Factor or “P-Factor” is a measure of economic efficiency “services” that show a direct impact to the vision and mission of the agency. Productivity is measured by hours worked divided by the total number of hours available throughout the work year. The standard business rule applies and the formula is 12 holidays, 10 vacation days, and 8 days of either absent sick or absent personal, for a total of 30 days or 240 hours of leave.

$y = x / b$ represents the percentage (Y) as a function of total-factor productivity, (X) productive hours input divided by, (B) total hours for a given year. Therefore the total productive hours for a given year is 1840 hours. Divide 1840 by 2080 equals 88.5% Eighty-eight point five percent is the productivity factor in this example.

Realization Labor Factor or “R-Factor” is a measure of economic inefficiency. Realization is the summation of total “Leave Hours” divided by the total “Productive Hours”. The percentage is applied back to direct hours to achieve a full time equivalent (FTE). An Example: $240 / 1840 = 13\%$ $1.134 * 1840 = 2080$.

Why do we need to understand the above factors? Productivity is a common measure that is used throughout the Aerospace Industry. The “P-Factor” is the key element in developing good COST ESTIMATING RELATIONSHIPS (CERs) for estimating Labor. The other element is the “learning curve” or “O-Give Curve” which is not part of this topic. However, the O-Give curve has been studied in length and must be considered performing new work. Realization or “R-Factor” gets applied to Direct Labor actuals. It encompasses the labor overhead to the forward pricing rates. Forward Pricing rates proposal and agreements (FPRP) and (FPRA) are established each year and get updated when needed. FPRA could also be called “Billing Rates” for Reimbursable activities and other transactions.

The “P-Factor” and the “R-Factor” is not clearly understood by the agency nor at the ten NASA Centers. The single contributing factor is the agency Financial Accounting System or SAP. The “Leave Allocation” formula is under constant review by the Office of Chief Financial Officer (OCFO) and at the time of this white paper is being written it is the author’s understanding the “leave allocation” is being reformulated. With this said, it is in the best interest to the Agency and the ten NASA Centers to report on the “P-Factor” annually. Changes to the “P-Factor” could be the direct result in the age of NASA’s workforce. The higher the age . . . could reflect in a person who has a large amount of annual leave. The average age in the agency appears to be shifting. With the Baby-Boomers Syndrome among us there is a big wave of retirements plans to retire within the near future. Several studies like the (Shuttle Transition Report) have been initiated to uncover and examine this anomaly. NASA will ultimately see a drop in “R-Factor” and thus show increase in productivity. The strategy is to hire Engineers and Scientist of very good skill qualities and proven proficiencies to off-set the O-Give learning curve.

How the P-Factor and R-Factor gets derived from Payroll Data:

The best source to extract the “P-Factor and “R-Factor” is from an unofficial data source commonly known as Webtads pulled from the payroll system. Data can be extracted on an annual basis or at fiscal-year-end. This can be done for the entire agency and at the ten NASA Centers. The Webtads Labor Reports have financial records that include project information/labor codes, by employee names, regular hours worked, overtime hours worked, paid leave hours, comp-time earned hours and much more. For this study only regular worked and paid leave hours are needed to extract the “P-Factor”. See Figure 3-1 on the next page.

The next step is to extract the same data every month. The one major constraint for the agency is to align the payroll period to an Accounting Month Calendar ~ not by month-end. If a payroll period is based on 2 weeks then we would see an 160 hour payroll month. There should be ten months that reflect 160 hours and two month that reflect 240 hours for a total of 2080 hours. Once the proper Accounting Calendar is constructed and approved then one can pull pay-roll data pay-roll period and align to a given payroll month. Figure 3-2 on the next page reflects the “R-Factor” for a typical NASA Center for a typical year. The chart reflects a high amount of “Leave” over the Christmas holidays and a lower amount over the March, April, May time-frames. The KEY POINT to this white paper is what are the drivers for the annual productive hours? What is the cause and effect relationships?

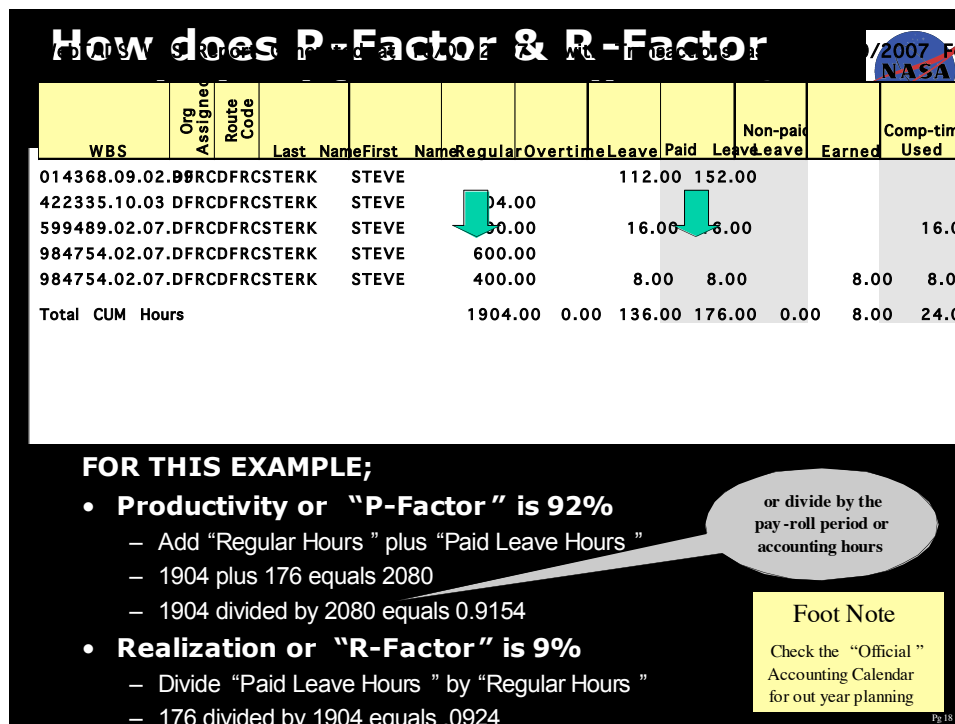


Figure 3-1 How does the P-Factor & R-Factor get derived from Payroll Data

A typical NASA Center "Leave Analysis" reflects a high level or "spike" of leave over the traditional holiday season overlaid with five years of monthly time-phased data. The "red line" show the composite trend analysis.

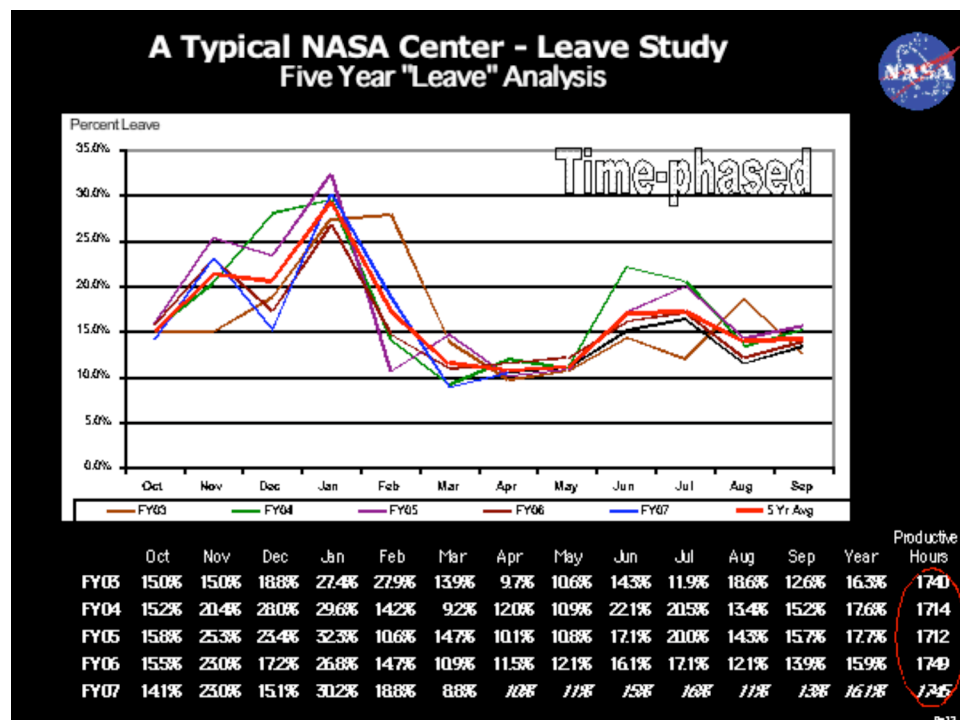


Figure 3-2 A Typical NASA Center – Five Year "Leave" Analysis

Can we correlate “Age” with “P-Factor”?

If we know how many full time equivalents (FTEs) at each NASA Center and the average age of the FTE, can we predict the “P-Factor and the “F-Factor”? The answer is **yes**. Figure 3-3 reflects the annual hours worked. The equation is regular hours plus paid leave hours which generates total hours for a government fiscal year.

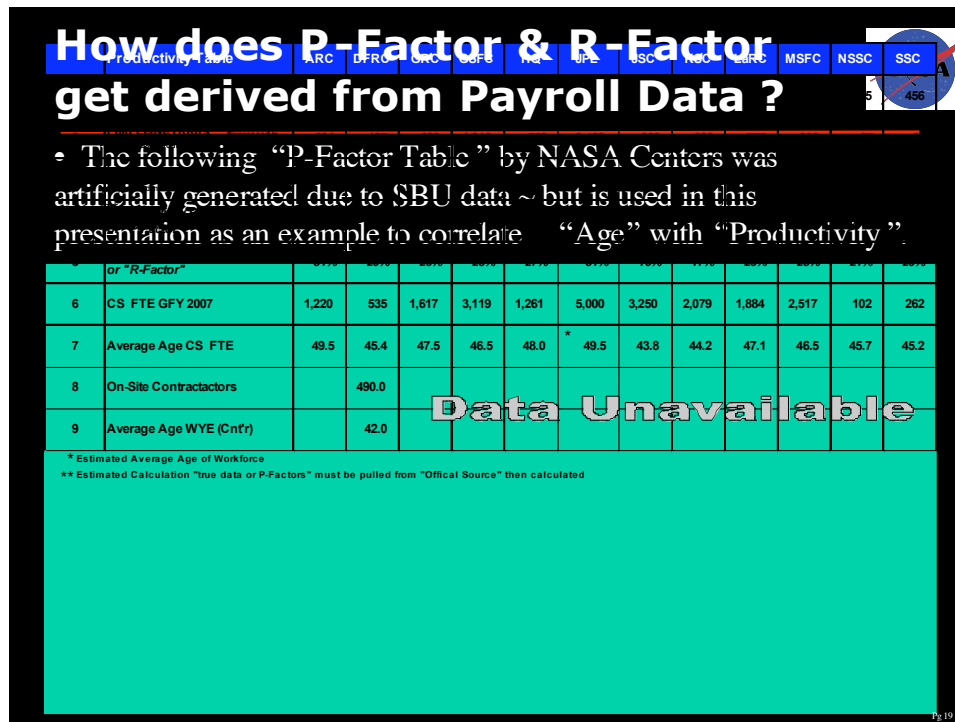


Figure 3-3 How does P-Factor and the R-Factor get derived from Payroll Data

The lower the productivity percentage or “P-Factor” directly correlates to average age of the workforce for a typical NASA Center.

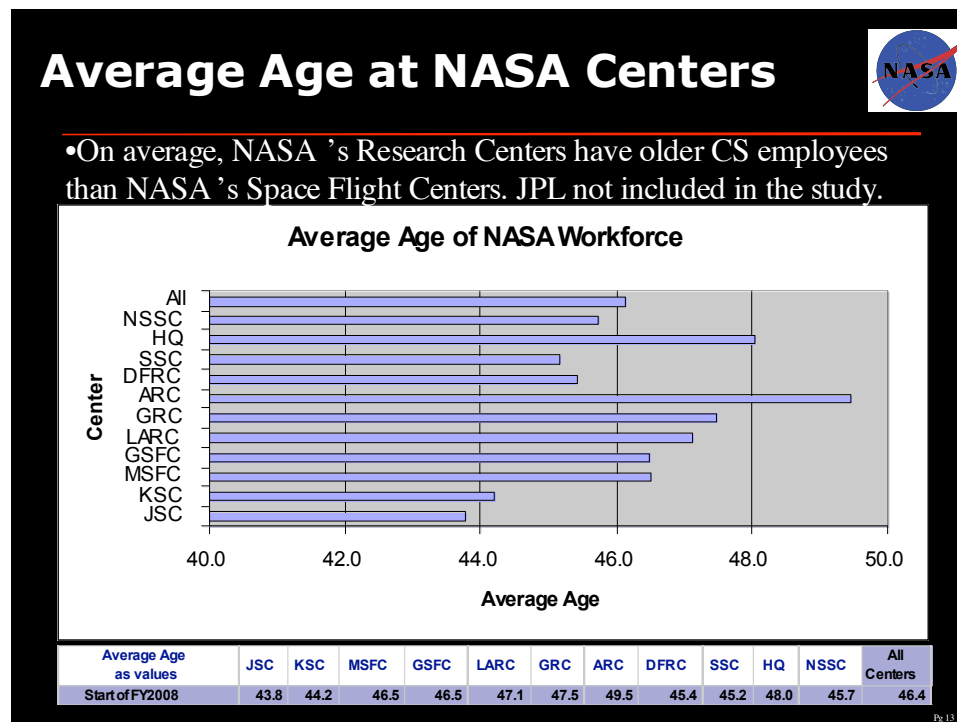


Figure 3-4 Average Age at NASA Centers

How to develop Forward Pricing Rates Proposal:

The following is a 10 Step approach to develop CERs, FPRP and a FPRA based on the P-Factor.

- **Step 1** - Determine if the Forward Pricing Rates will be by Branch / Department or by a specific Project Type?
- **Step 2** - Pull “actuals” Labor Rates by Branch from the Labor Pricing Module (WIMS or LPM)
- **Step 3** – Divide the actuals Cost by the number of civil service workforce (CS FTE) to get the “Average Rate by Branch”. Things to be cautious of are; Temporary Employees, Co-Ops, College Hires, etc.
- **Step 4** – Determine the Employee Fringe Benefit (EFB) Currently – Foot note: I believe the agency is using a percentage like 24.45%. The Labor Pricing Module (LPM) may have an accurate Employee Fringe Rate by Branch.
- **Step 5** - Add or multiply the “Direct Labor Rate” plus the EFB
 - Direct Labor Plus EFB Equal Direct Labor “Burdened”
 - \$90,000 Plus \$22,005 Equal \$112,005
 - \$90,000 Times 24.45% Equal \$112,005
- **Step 6** – We all agree that \$112,005 is the Average Salary Yearly rate – but we are developing a FPRP, RPRA or Billing Rates using Direct Labor Hours as actuals. SO WHAT DO WE DO?
- **Step 7** – Multiply the P-Factor 83% (look at prior Figure 1-4 under (DFRC) multiply the number of total hours from the “official” Accounting Calendar i.e. 2080. The results is 1731 Hours.
- **Step 8** – Divide “Direct labor Burdened Salary” by 1731 or the P-Factor the results is \$64.71 per hour for the budgeted year (BY) Caution – you may want to add an inflation or o-give rate depending on the (time-period) as to when you pulled your “actuals”.
- **Step 9** – Multiply the appropriate inflation rates for out-year planning for Civil Service Salary are provided in the Strategic Planning Guidance (SPG).
- **Step 10** - is a Sanity Check
 - Stop and think through all the possible scenarios
 - A.) Salary rate Increase are normally the 2nd Quarter ~ or about 3%
 - B.) How many Promotions are in-line for the Branch . . . ?
 - About 1.4% is a good rule of thumb for a given year
 - C.) How many CS FTE will Retire in a given Year . . . ?
 - Remember the Baby-Boomer Syndrome
 - A higher than normal retirement number will decrease the out year rate.
 - D.) What is the general feel for the Branch . . . ?
 - Is there foreseeable growth within the Branch . . . ?
 - Or is the technology on the way out or in transition . . . ?
 - E.) Other unknowns-knows or unforeseeable events . . . ?
 - F.) Can the Forward Pricing Rates pass the Sanity Check or a Peer Review or be defensible by the Government Auditing Organization (GAO) Cost Assessment Guide . . . ?

The same approach addressed earlier can be used, however be advised to use extreme caution when developing CER's by Project. Why? __ Program / Project CERs have a “life Cycle Cost (LCC) meaning; work that is performed at the beginning of the program (example: Planning) is not the same workforce at the middle nor at the end. The most important reason for differentiating between recurring and non-recurring cost is in their applications to learning curves. Simply put; learning curve theory applies only to recurring cost. Cost improvement or learning is generally associated with repetitive actions. Therefore labor rates on a Program / Project are generally more subjective to change (year-by-year) than be Branch.

Best Practices and Standards:

There is a need for “Standards” either from the American National Standard Institute (ANSI) or from International Organization for Standards (ISO) to help bridge the gap between Cost Estimation and Earned Value Management (EVM).

The Government Auditing Organization (GAO) has developed the Cost Assessment Guide in order to establish a consistent methodology based on based practices to be used across the federal government and federal agencies for the development and management of its program cost estimates.

The primary “exposure draft” currently reflect 20 chapters documents, 323 pages. Highlights includes: Cost Estimators’ Check List, backed-up with case studies, graphs and tables.

The purpose of the guide is;

1. to address the generally accepted best practices for ensuring credible program cost estimates.

2. to provide a detailed link between cost estimating and earned value management.

GAOs, Cost Estimator Check List (Reference Exposure Draft - dated 7/4/07) is as follows:

- The documentation should describe the cost estimating process, data sources, and methodologies in a step-by-step fashion so that a cost analyst unfamiliar with the program could understand what had been done and replicate the estimate.
- There should be adequate supporting data included in the documentation so that the estimate can be easily updated to reflect actual costs and / or program changes and the resulting data can be used as a basis for future estimates.
- The documentation should include both narrative text and cost tables to describe the basis of the estimate.
- Documentation should follow a standard format including an executive summary, introduction, cost estimate methodology and data broken out by WBS cost elements, sensitivity analysis, risk/uncertainty analysis, management approval, and updates to reflect actual costs and changes
- Documentation should make sense, both mathematically and logically.
- The documentation should include a discussion of contingency reserve and how it was derived based on the risk / uncertainty analysis and life cycle cost estimate funding profile.
- Results should be presented in formats that are useful for preparing reports and correspondence for higher authority.
- An electronic copy of the cost methodology/model and data should be provided with the cost estimate

Similar to the 32 Guiding Principles for Earned Value is a 12 Step Process for Cost Estimation.

GAOs, High Quality Cost Estimation 12 Step Process (Reference Exposure Draft - dated 7/4/07) is as follows:

1. Define the Estimate's Purpose
2. Develop the Estimating Plan
3. Define the Program Characteristics
4. Determine the Estimating Approach
5. Identify Ground Rules and Assumptions
6. Obtain the Data
7. Develop the Point Estimate
8. Conduct Sensitivity
9. Conduct a Risk and Uncertainty Analysis
10. Document the Estimate
11. Present Estimate to Management for Approval
12. Update the Estimate to Reflect Actual Costs and Changes

What I like about the steps is one can then articulate a stop light scorecard across the agency and reach out to the ten NASA Centers to see if they are performing to the "standards". Figure 4-1 reflects a sample of the scorecard.



Figure 4-1 12 Steps for High Quality Cost Estimation ~ becomes the “Standard”

Who are the Cost Estimators and what are their Skill Level or Competency across the ten NASA Centers?

The answer to this question comes from NASA’s Competency Management Systems (CMS). Currently there is only one competency in the data dictionary that addresses “Cost Estimation”. It is (CMS) code number 0121. Currently there are about 1,400 civil service at NASA that states they have a skill code for Cost Estimation. There are several factors here that need to be address; 1.) CMS has five levels or Tiers. The definition of a Tier is as follows;

1. **Tier Level #0** – is an individual seeking knowledge of cost estimation. Knows that there is a competency for cost estimation yet the manager has not rates the individual.
2. **Basic Level Tier Level #1** - An individual has a basic knowledge of the subject matter and shows an awareness of how this competency relates to their job.
3. **Working Knowledge Tier Level #2** - An individual has a working knowledge of the subject matter such that they are able to effectively apply that in their job.
4. **Proficient Tier Level #3** - Through the experience of applying their knowledge on the job, or other related activities, an individual has developed a thorough understanding of the subject matter AND is highly proficient in being able to apply that knowledge in their work environment.
5. **Subject Matter Expert (SME) Tier Level #4** - Through years of experience, or advanced study, an individual has developed a comprehensive understanding of the subject matter and its interactions with other disciplines/competencies. The individual has advanced their set of skills to be able to apply their expertise to a multitude of projects and situations. The individual utilizes their in-depth knowledge to communicate and collaborate with peers within their normal work environment and outside to other professional business or technical communities.

The following figure (Figure 5-1) reflects the numbers of cost estimators from across the ten NASA Centers. However, upon investigation there seems to be a misunderstanding of what the data reflects. One person interviewed was a pilot. The pilot (Tier Level 1) at a test research facility stated that he “performs cost estimates to determine on a monthly basis ~ how much JP5 fuel is needed to perform atmospheric flight test and the cost associated with those activities.”. The competency was not his primary skill, but the skill based on a percentage of his duties.

Thus the questions remains who are the Parametric Cost Estimators? __

As this paper is being written there is on-going communication at NASA Headquarters is to update the competency CMS Dictionary. Several scenarios are being discussed. 1.) to add “Cost Engineering” as a competency. The thought here for this particular competency is the person must be “certified”. The person must show proof that he or she has passed an exam similar to one of three professional societies like; ISPA, SCEA, or AACE. 2.) Another possibility is to add “Parametric Cost Engineering” to the dictionary. This would encapsulate all the folks who work on and use NASA AirForce COst Model or (NAFCOM). NAFCOM is a parametric cost model derived from actual cost from the Apollo era. CERs are being updated on a monthly basis and is one of the agencies leading parametric cost models to derive the cost for ARES and ORION spacecraft.

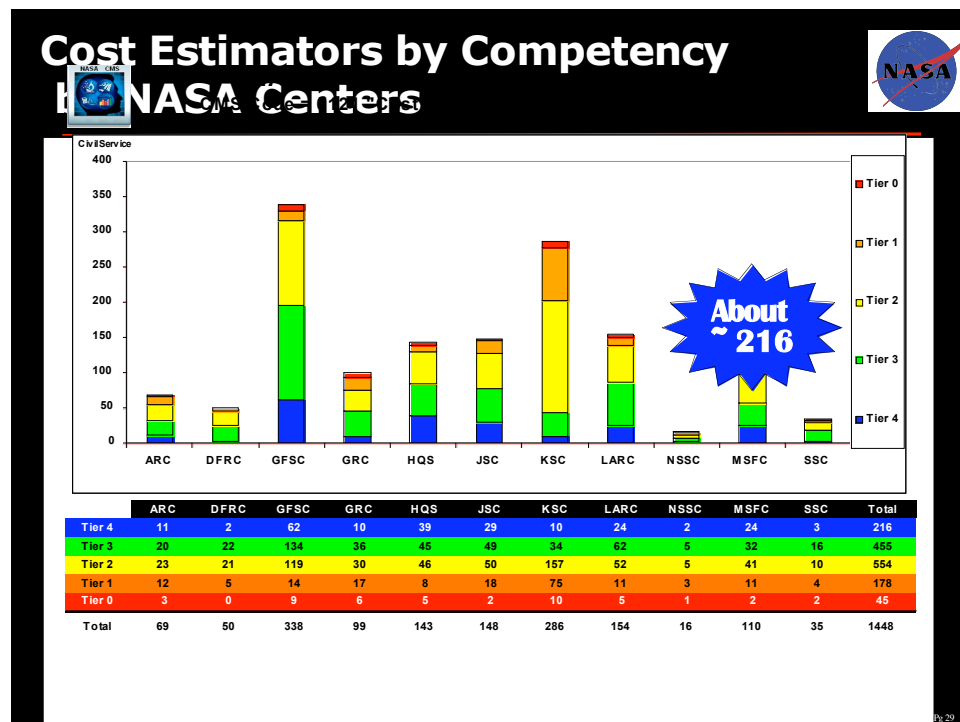


Figure 5-1 Cost Estimators by Competency by NASA Centers

Gray Beards versus the younger age workforce:

CMS Tier Level 3 & 4 is where the work is being performed. Gray Beards are often seen as the subject matter experts. Usually can be spotted at conference and symposiums like the one we are at today.

- Gray Beards can often perform a Cost Estimates is less time than a Junior Estimator and are probably “more productive” in-terms of producing a credible cost estimate. With the baby boomer syndrome rapidly approaching ~ Gray Beards needs to become “coaches”.



- The symbol (right-hand corner) reflects ~ is the same symbol on NASA Cost Analysis Steering Group's (PBMA) Web Site.
- We MUST continue to communicate to one another, express one thoughts ~ into actions for the future of NASA Missions.

Summary:

General conclusion from the National Research Council is;

- NASA Could be in a position between 2012 and 2018 to have enough skilled personnel in areas key to implementation of the Vision for Space Exploration.

2. Sustained excellence in space-related science, engineering, acquisitions, and other operational disciplines is vital to the future of U.S. space capabilities.
3. Departments and agencies that conduct space related activities shall establish standards and implement activities to develop and maintain highly skilled, experienced, and motivated space professional within their workforce.

As the author for this paper ~ I have to agree with the following recommendations as referenced by *Building a Better NASA Workforce*, as determined by the National Research Council – 2007 Report and the 2006 Report.

Building a Better NASA Workforce 2007 Report

Recommendation #1 - Collect detail data on NASA's workforce requirements at the Center Level. A bottom-up assessment of the current skills, experience levels and projected attrition for each individual NASA Center. Ensure that hiring constraints, such as pay-levels, ceilings and ability to recruit can be met.

Recommendation #2 - Hire and retain younger workers within NASA. Take full advantage of NASA Flexibility Act of 2004. Develop solutions that limit the flow of senior and highly skilled employees from industry to NASA.

Recommendation #3 - Ensure a coordinated strategy for aerospace workforce development among relevant institutions. Work together to develop an effective aerospace workforce ecosystem.

Building a Better NASA Workforce 2006 Report

Recommendation #1 - develop a workforce strategy for ensuring that it is able to target, attract, train, and retain the skilled personnel necessary to implement the space exploration vision and conduct its other missions in the next 5 to 15 years.

Recommendation #2 - adopt innovative methods of attracting and retaining its required personnel and should obtain the necessary flexibility in hiring and reduction-in-force procedures, as well as transfers and training, to enable it to acquire the people it needs. NASA should work closely with the DOD to initiate training programs similar to those that the DOD has initiated, or otherwise participate actively in the DOD programs.

Recommendation #3 - expand and enhance agency-wide training and mentorship programs, including opportunities for developing hands-on experience, for its most vital required skill sets, such as systems engineering.

Authors Conclusion:

This paper reflects a collection of ten years of historical data from two very different types of organizations which are; 1.) Workforce Planning and 2.) Cost Estimation. Some of the data used in this paper was produced from "data cubes" high powerful Hyperion software that is manipulated in seconds and presents a simple report. Other data; like the "P-Factor" was data mined from bi-weekly payroll period time card collection system ~ extracted from five years of payroll data, from various NASA systems and data bases that appear to be stove-piped from one organization to another. Meaning that it is hard to get your hands on the data, but have to endure personalities, figure heads, data base security rules, etc. ~ to simply obtain the data. Over 400 hours went into this paper to just to build one chart reference Figure 3-2.

However, this paper continues to foster the **ONE NASA** vision / philosophy across the Agency. By Co-Authoring this white paper and presentation with Stephan Chesley, Workforce Planning Specialist ~ has energized or spirits towards having a human presence on the lunar surface within the decade and make on-going accomplishments in which one day we as a nation, will have a human presence on the red planet Mars.

The agency simply needs to "adopt" NRC recommendations in "*Building a Better NASA Workforce*". As Cost Estimators we all know that "a bottom-up cost estimate" is more desirable than a top down approach. We must work with the Center's Workforce Planning Teams to identify "who are the Cost Estimators? What are their skills, . . . Who plans to Retire, . . . ? Etc..?"

NASA Workforce Planning in collaboration with Cost Accounting should consider to lead the Agency in “Bench-marking” Productivity Factors at each Center. Correlate “age” with CERs and produce a Forward Pricing Rate Document from the Office of the Chief Financial Office (OFCO) that is not only auditable but can also be validated.

Help establish a Forward Pricing Rate Proposal Process with a “Discloser Statement”. New budgets are being developed on a daily basis, as the internal strategy for the agency seems to shift every two years. By developing a process that would produce a concrete document with rate information, coupled with a discloser statement the Cost Estimating Community could better determine the overhead rate for the agency. By determining the rate for Center management and Operations (CMO) as an example. Or “what is . . . or what is not ” covered in SCAP. By working in conjunction with the Offices like: Office of the Chief Financial Officer (OCFO), and various Program Offices like the SCAP Director at HQ, could help resolve “Full Cost Issues” when performing “in-house” cost estimates.

Adopt GOA’s Cost Assessment Guide (CAG) as the “Best Practices”, soon as it is released (expected 3rd Quarter of 2008). Roll-out the CAG to all of the NASA Centers. The Executive Cost Analysis Steering Group (ECASG) should lead in performing a self-assessment stop-light metric scorecard, benchmark 2008 across each NASA Centers (no later than the 4th quarter of 2008). The PA&E CAD should make recommendations (living guide) back to GAO. Which in-turn will help to develop NASA Standards for the future of space exploration. NASA PA&E CAD should lead in the develop of a “Certification Process” for NASA’s Cost Estimation Civil Service Community. This needs to be done in conjunction with Human Resources (HR). “Saturn” is an on-line training program. The current Tier System (Levels 1 thru 4) has a very subjective rating system and may be inconsistent at each NASA Center. Career development recommended by the NRC (training and certification) for the Cost Estimator is essential **for the future of NASA Missions.**

NASA Cost Estimators should also pursue additional outside education sources; consider to join a professional cost society like; Society of Cost Estimating and Analysis (SCEA) or International Society of Parametric Analyst (ISPA). Both Societies have an established “Certification” process.

Questions ?

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Speaker Biographies:

Steve Sterk (CPP) works at NASA's Dryden Research Flight Center on Edwards Air Force Base as a Cost Engineer, Cost Estimation Manager and Workforce Planner. He has conducted a multitude of Cost Estimates for various aeronautical research projects and future exploration projects, an independent cost estimates for NASA aeronautics augmentation proposals and a multitude of independent assessment for a variety of NASA Dryden full cost assessment and projects, including Center Management and Operations (CMO).

Steve recently received a NASA Level 2, Program Manager's Award for Vehicle Systems in 2005 for his independent cost model. Other awards include an Aero-Space Industry President's Award, for his effort in assessing the cost effectiveness on benefits (Group Insurance Rates) in developing a ten-year cost assessment and developing a site rate for Palmdale's Space Shuttle modification facility. He assisted with the corporate merger of heritage; Rockwell International, the Boeing Company & McDonald Douglas. He help build hundred B-1B Bombers, which came in ahead-of-schedule and under cost. Other awards includes a Congressional Merit of Honor and a Palmdale Major's Proclamation Award. He is a certified parametric practitioner, he currently serves on the board of the International Society of Parametric Analysts (ISPA) as the Members Relations Officer and actively sits on the Southern California Chapter Board of Directors.

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References

National Research Council

Committee on Meeting the Workforce needs for the National Vision for Space Exploration

2007 Report ISBN: 0-309-10838-1, 76 Pages <http://www.nap.edu/catalog/11916.html>

2006 Report ISBN: 0-309-66114-5, 60 Pages <http://www.nap.edu/catalog/11642.html>

National Academy of Public Administration Study

Building a Better NASA Workforce

6 Findings with Recommendations, very similar to the NRC Study

http://www7.nationalacademies.org/ocga/testimony/Building_a_NASA_Workforce.asp

GAO Report (Dated May 2004) GAO-04-642

NASA Lack of Disciplined Cost Estimating Process Hinders Effective Program Management

<http://www.gao.gov/new.items/d04642.pdf>

NASA PA&E

Meeting on Strategic Workforce Management Model (SWMM)

Further populate Demand and Supply Model (Get the Baseline Right)

Improve the fidelity of the WIMS data within the budget horizon

For existing projects, extend the WIMS data beyond the budget horizon

ASTM International Cost Estimate Standards

[http://www.astm.org/cgi-](http://www.astm.org/cgi-bin/SoftCart.exe/DATABASE.CART/REDLINE_PAGES/E2516.htm?L+mystore+dfdq1480+1183355467)

[bin/SoftCart.exe/DATABASE.CART/REDLINE_PAGES/E2516.htm?L+mystore+dfdq1480+1183355467](http://www.astm.org/cgi-bin/SoftCart.exe/DATABASE.CART/REDLINE_PAGES/E2516.htm?L+mystore+dfdq1480+1183355467)

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